

# Psychological Bulletin

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HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)  
JOHN B. WATSON, JOHNS HOPKINS UNIVERSITY (*J. of Exp. Psych.*)  
JAMES R. ANGELL, UNIVERSITY OF CHICAGO (*Monographs*) AND  
MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

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THE  
PSYCHOLOGICAL BULLETIN

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GENERAL REVIEWS AND SUMMARIES

DYNAMIC PSYCHOLOGY

BY F. L. WELLS

*McLean Hospital*

Watson's (13) presidential address begins with reviewing the development of his behaviorism concept since its formal launching. Then he discloses in the conditioned reflex a very promising method for putting the concept to the test of action. First he describes the conditioned salivary reflex, but it is difficult to adapt the technique to human beings, and other phases of conditioned reaction are preferred for investigation. An important footnote hints at the relationship of the conditioned reflex to certain pathological symptoms. His main problem has lain in training differential reflexes; that is, reflexes which are educated to appear to certain stimuli to the exclusion of other similar ones. Its relative independence of coöperation and availability in human and infra-human subjects are features to be emphasized. The latter it shares with the "multiple choice" method. He takes a hopeful view of its application to pathological cases which cannot be reached by means of language, and seems indeed to have laid his hand on a most valuable instrument for their study.

Hollingsworth (3) presents a review of different psychological methods available for vocational guidance, and the principles underlying their application. The apparent need of supplementing vocational training by vocational selection leads to the work the volume describes. A very useful list of sources for material, etc., is appended to the book.

Adams (1) reviews the work that has been done in "testing the tests" of merit in advertising, and recounts an original experi-

ment in this direction, using mail-order material. The general tendency of his results is negative. Analysis is given of different measures of advertising merit, and of the sources of error in laboratory tests of advertising.

A long step forward in the field of mental testing is marked by the appearance of Terman's (12) book on the Stanford revision of the Binet series. The opening third of the book is occupied with a discussion of the functions of intelligence testing, to which he gives a broad interpretation, some historical accounts, and general criticisms. The remainder takes up the tests for the different years one by one, and gives for each the procedure, the scoring, and various remarks.

The free association test seems to be one of marked intrinsic merit, which does not reach the full measure of its usefulness because it has not attracted the body of investigation that has grown about other experimental methods. Two interesting studies of Lange (6, 7), on pathological changes of association type, and its rôle in the interpretation of persecutory delusions, are simply mentioned here. A suggestion is thrown out by Moore (9) for using an allied test in measuring the strength of instinctive tendencies. Dooley (2) reports a study by this method of "normal complexes" using the term in Hart's sense. "Common" and individual complexes are distinguished. The rôle of unconscious factors in determining associations is substantiated, but no ground appeared for formulating a general operation of sexual or infantile factors.

The translation of Jung's (5) *Wandlungen und Symbole der Libido* by Dr. Hinkle is the most conspicuous contribution of the psychoanalytic school. This is a review, quite extensive, not very systematic, and varying much in convincingness, of a fascinating subject in the relation between the contemporary "unconscious" and the contents of former myths and folk-usages.

In observations of a single case, Schneider (11) carries out the notion of a common mechanism in primitive and pathological ideas. Thus he relates pathological delusions to various myths. In this connection should be read an article by Lowie (8), who points out that similarity of content is not a sufficient criterion for unity of origin in folk-ideas. Not logical, but pre-logical (unconscious?) associations are the essential factors in these symbolisms. He is particularly impressed with the number-form phenomena recorded by Galton, and with their seeming to be



hereditary. He feels that in a similar way numbers and other ideas could come to have symbolic associations whose spread would be facilitated by the fact that there is so much blood-relationship among primitive communities.

In Read's paper (10) the distinction is made between two types of animism, (1) the proneness of uncultured people to explain natural phenomena by the action of spirits (hyperphysical animism); (2) the endowment of objects in general with animate and purposive consciousness (psychological animism). Examples are given illustrating how such illusions are stopped short of interference with vital needs of the people, and how on the other hand they are allowed to interfere greatly with the group's economic welfare. Four classifications of beliefs about animism are explained, and conditions are described which favor an object's acquiring animistic properties. Political evolution has an important part in the development of animism, the different hierarchies of this world being reflected in those of the other. Low-grade tribes have little animism; religion begins with the differentiation of superior beings, which in turn contributes to the dissolution of animism.

In a paper on repression and memory Ernest Jones (4) considers that while the action of repression is seen mainly at the transition points of the various levels of consciousness, these tendencies appear to be generally distributed, increasing in strength as one approaches the lowest layers of the unconscious. Though there is much agreement that pleasurable impressions are the better attended to, ideas not apprehended in consciousness may make a deep impression below this level. Considering the capacity of the unconscious for storing up impressions, the problem becomes rather, why so little becomes conscious. The force maintaining forgetting seems to come from the direction of consciousness rather than the unconscious. Repression also affects, secondarily, ideas that are connected with the unpleasant one. The emotion may be repressed independently of the other elements of the idea. The author greatly extends the rôle of repression in forgetting, classifying it for convenience into hedonic repression, which inhibits ideas through their special unpleasantness, and the utilitarian repression of simply irrelevant ideas, which derive such unpleasantness as they have, merely through the fact of their irrelevance.

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## INSTINCTIVE TENDENCIES IN MAN

BY JOSEPH PETERSON

*University of Minnesota*

In man instinctive tendencies are much complicated through intermixture with environmental factors, consequently considerable confusion exists both as to characterizations of the various instincts recognized and as to methods of studying them. Thorndike (37) has made a creditable attempt to clear up some of these difficulties. Man's original nature is first stated in neural terms, and secondly, when this leads nowhere practically or experimentally, in terms of tendencies to response. These tendencies must each be defined "as a situation, a response and a degree of probability that apart from training the latter will happen when the former does." He finds our knowledge of instincts on very insecure foundations, especially that gained from the questionnaire method; and offers a tentative inventory and description largely on the basis of personal "observation and judgment."

Moore (20) outlines an experiment to determine dominant instinctive tendencies, based on the association tests. Subjects are to respond to words significantly related to particular instincts.

Myers (21) describes the movements of a developing infant, and finds a slight but questionable preponderance of left-handedness to the 189th day, after which the child almost invariably reached for things with the right hand. Dupuis (12), in conformity with his "psychasthenic theory" of timidity, describes cases of timidity in terms of motor and social anomalies, various degrees of slowness or weakness (*lenteur*) of movement and of "social apraxia" being found in association with mild forms of "hyperesthesias of the self." Folsom (13) recalls memories of his child play-world, showing stages of different interests. Coover (10) finds experimentally no basis for the rather common belief in an instinctive feeling of being stared at. Cannon (4, 5) describes the "effects" on certain viscera of some of the stronger emotions, and shows that by the secretion of adrenalin the individual is prepared for emotional crises. He agrees with Sherrington in finding only slight differences in reaction in the viscera for the different kinds of emotion. He shows a tendency to regard emotion as forces producing these visceral changes; his book and article, however, are loaded with useful facts. Crile (11) shows this same view, but is far less scientific. Angell (1) examines objections by Cannon and others to the James-Lange theory of emotion and finds the latter, when properly understood, untouched by any evidence thus far established. Titchener (39) traces the antecedents of James's theory and concludes that "James's acceptance of the complete novelty of his theory must . . . be left to stand as something of a curiosity in the history of psychology." Of recent important texts Titchener's (40) discusses instincts in connection with emotions and avoids in the consideration of their origin the author's former questionable position of assuming the transmission of somatic changes. Pillsbury (26) devotes considerable space to instincts, and seems to follow Cannon in the view that emotions *cause* visceral reactions and certain secretions. This same position seems to be taken by Jastrow (18) who frequently refers to emotions as causes that "move to action." He gives valuable detailed descriptions of modification of emotions into sentiments, and follows Shand (34) in regarding emotions and sentiments as dominating conduct. McDougall more definitely characterizes and describes the functioning of the sexual instinct (22, 23) than he has heretofore done.

The importance of the instinctive basis of human conduct, for which to the reviewer's mind McDougall (22, 24) more consistently argues than do those who place the motivation in the emotions,

seems to be gaining ground. Wallas (47), who accepts this general position, places the emphasis on the emotional aspects, due to a less accurate psychological basis, and rejects the view that thought is a mere "apparatus" set in action by the instincts; but he makes the tendency to think a separate instinct! Other writers emphasizing the importance of instinctive tendencies on thought and action are Cabot (6), Curtis (8, 9), Hall (14, 15), who urges the extension of Freudian conceptions to other instincts besides sex, Putnam (29), Santayana (33), Trotter (41), and Wright (45). It is regrettable that the limitation of space does not permit more notice of these contributions here. Special instinctive tendencies are discussed, often without careful definition and clear conceptions of instinct, by writers whose work can only be indicated (2, 3, 7, 16, 17, 27, 28, 30, 31, 35, 38, 43, 44). Play gets a large share in this list. Many writers are finding "real life" as well as cure from many evils in instinctive activities like play.

Watson (46) and Parmelee (32) give valuable discussions of the origin of instincts, the former suggesting that a special mechanism for, and hence instinct to, language habits is the chief basis of difference between the behavior of man and that of higher animals. Watson emphasizes Mendelian factors, the non-transmissibility of "continuous variations," and, somewhat inconsistently and on the basis of questionable experimental evidence, the transmission of "acquired characters." He regards instincts as a chain of reflexes.

Stout (36) and McDougall (22, 23) have revived in a measure the innate idea, or rather have developed an innate perception, doctrine. Morgan (25) reacts against this tendency, but accepts it in a measure with misgivings. It seems to the reviewer that more careful attention to the rôle of experience in effecting differentiations in stimuli to instincts would be in order before such speculations are taken seriously.

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## VOLUNTARY PHENOMENA

BY R. S. WOODWORTH

*Columbia University*

Abramowski (1) set his subjects the task of inhibiting the emotional response to various stimuli—lights, noises, words for associative reaction, numbers for calculation—using the psychogalvanic reaction as the indicator of emotion. Of the 24 subjects tested, a few certainly reduced the extent of the galvanometric deflections; a few gave larger deflections when they tried to inhibit emotion than at other times; while others gave no consistent result. The results for all the subjects taken together are so irregular that they might be interpreted simply as chance variations; but the author rejects this interpretation in the case of those subjects who gave a consistent result, especially when the result was in harmony with the known strength or weakness of their habitual voluntary control over their emotions. He is able also to exclude the hypothesis that the inhibition, when it occurs, results from the interference of one emotion with another; and believes that the

only possible explanation is in terms of voluntary effort inhibiting emotion. The fact that the control improved with practice seemed to substantiate this view. Introspective testimony, though vague as regards the mechanism of control, made mention frequently, in the case of the successful subjects, of voluntary effort directed toward the isolation of the deeper self from the influence of the stimuli, and the creation of a "mental void." The author conceives this process as an auto-hypnosis, which maintains by suggestion a state of indifference towards the stimuli, and produces an asthenic state of the organism, one effect of which is the diminution of the psychogalvanic reactions. He found that voluntary changes in respiration had no regular effect on the psychogalvanic reaction, and that voluntary contraction of the muscles, while it produced a diminution of the psychogalvanic reaction in most individuals, failed to do so in some of those who were able voluntarily to inhibit the reaction. Alcohol and opium, administered because of their circulatory effects, also had no uniform effect on the psychogalvanic reaction. From these results the author infers that the voluntary inhibition of the reaction is not accomplished directly through these organic changes and without reference to emotion. He also paid some attention to the state of the respiration and muscular tension while the subject was endeavoring to inhibit emotional responses, and found the respiration somewhat slowed and considerably lessened in depth, while the muscular tension was increased in some subjects, but not in those who had most success with the inhibition. It seems possible that some individuals seek to control their emotions by an inner concentration, and others by an outwardly directed effort.

Facilitation and inhibition, so important in reflex action, are looked for by Langfeld (5) in the sphere of voluntary movement. He employs the tapping movement for his purpose, using the first, second and fourth fingers of each hand in a variety of combinations, alternating and simultaneous. The first and second fingers tapped at almost the same rate, the fourth much more slowly; the fingers of the left hand generally were slower than those of the right, but the index of right-handedness differed considerably with the different combinations.

*Simultaneous movements.* If the rates of two fingers, tapping singly, are about the same, the rate of the two tapping together is again about the same, sometimes a little greater in the case of the first and second fingers of the same hand. When two fingers tap

singly at quite different rates, both together generally tap at an intermediate rate, though sometimes not more rapidly than the slower of the two. The faster finger usually pulls the slower along with it to some degree, or facilitates its movement, while being itself impeded or partially inhibited. The results in detail suggest, without fully proving, that the facilitating influence of the faster upon the slower finger increases with the difference between the rates of the two fingers, and also with the degree of bilateral symmetry between the two.

*Alternating movements.* A "trilling" movement of the first and second fingers of the same hand gave almost always a rate for the two fingers together faster than either could reach alone; but the rate of each finger was less than it reached alone. Here inhibition was clearly exerted by the one finger upon the other, and was especially strong because the trill requires opposite movements of adjacent fingers to be executed simultaneously.

Warren's extensive study of purpose (7) includes a consideration of vitalism and of the rôle of purpose in nature generally, as well as an analysis of the purposive consciousness, this psychological part of the study lying however at the basis of the whole. The most general characteristic of the experience of purpose is that an idea or forethought of an occurrence precedes the actual occurrence, instead of the idea following the occurrence, as in perception. There is thus a reversal of the temporal sequence of events, as usually conceived; and the future appears as conditioning the present. The forethought may be in verbal, pictorial or (conceivably) non-imaginal terms; its only distinguishing mark is its reference to the future. Besides the forethought, there is always present in the purposive consciousness a factor of assent, which, on analysis, proves to consist of kinesthetic and organic data—"an incipient tension of the muscles concerned in the movement, and of the finer muscles which produce an adjustment of attention, . . . often accompanied by modifications of breathing and circulation," all combined to produce an indefinite conscious attitude, the assent. The so-called *fiat* is probably not a distinct factor. When the object of a purpose is ideational rather than motor—as in trying to recall a name—the forethought is only a partial representation of the event, and the assent is delayed in its appearance, since the problem leads involuntarily to experiments towards its solution.

Besides these two essential factors, the purposive consciousness may also include a "potency-feeling," closely related to assent,

and like it kinesthetic, consisting either of the sensations of the actually executed movement, or of the memory image of such movements. This potency-feeling is not to be accepted as a guarantee of real potency of the sort conceived by the theory of ideomotor action. Nor is the potency-feeling necessary to the execution of the purpose; it occurs mostly with complex forethoughts and when deliberation precedes the assent.

Another factor in purpose is the self, since the act proposed is to be one's own; but this self-factor is usually implicit, becoming separately conscious only "in complex cases of deliberation and so-called volition," and traceable then "to kinesthetic elements which arise during the process of fulfillment." Finally, the purposive experience may include, at its fulfillment, a sense of fitness (or unfitness), compounded of recognition and satisfaction. Delay in the fulfillment brings the sense of unfitness, and fulfillment after delay that of fitness. "The fitness experience is both a judgment and a feeling."

There is a fundamental tendency, says Renzi (6), for a wish to execute itself in action. Since, however, the performed act does not always yield the expected satisfaction, there arises a selection, on the basis of experience, of acts that produce satisfaction as against those that do not. This is a selection of means. But since, further, there exists a plurality of desires, the satisfaction of one interfering with that of another, there comes likewise to be a selection of desires, or of ends. The more inclusive ego suppresses the tendencies of the less inclusive, introducing thus the principle of utility into the life of will in addition to the principle of satisfaction which is present when a single egoistic tendency is unrestrained. The systematizing of tendencies under the principle of utility which thus results from the domination of the less inclusive by the more inclusive self cannot, however, give rise to anti-egoistic conduct. The source of self-denial must be sought outside the self. Self-denial is a real phenomenon, sometimes occurring with no motive beyond that of self-denial, and sometimes with an altruistic motive.

Wieg-Wickenthal (8), considering will from the standpoint of the psychiatrist, finds it more fundamental than intellect. Sensation and image play a very subordinate rôle in mental disorders, the most important and frequent disorders arising from a morbid will-function, an insufficient biotonus in the mental realm. The symptoms of all forms of dementia precox can be understood as

due to lowered biotonus with consequent weakness of active and passive apperception. The primarily intellectual insanities are rare. The author recommends the study of Schopenhauer. Kohnstamm (4), approaching the matter from much the same angle, maintains that life is subject to both causality and finality. "A need is no pure natural cause, . . . but a *causa finalis*, an end-cause; and exactly the same is true of a motive." Finality is the great characteristic of life processes, and in voluntary processes it comes to light as the consciousness of freedom.

Gemelli (3), in visits to the front and to hospitals, examined soldiers who had distinguished themselves by deeds of heroism, and compared them with others who had shown "nervousness" in the same situations. It appeared that the courageous soldier was not an exceptional individual, but often one of quite ordinary characteristics, who had been molded into the war mold. The molding process consists, on the negative side, in a detachment from family affections and all the ordinary interests of life. These are not lost but laid aside. The soldier lives in the present, his acts not being related to his past and future, as in ordinary life, but being determined from without, by the command of the officer. On the positive side, the molding process consists in an assimilation to the social medium and its guiding sentiments of honor, esprit de corps, discipline, and love of the company. Patriotism is too far-away a motive to have much effect. Besides this transformation of the personality, another factor predisposing to courage is the constant excitation from the neighborhood of so many other men, from the noise, the sight of wounded men, etc. A state of tenseness and readiness results which favors vigorous action at the word of command.

Ferrari (2) also seeks to revise the conception of courage in the light of recent experience. At the outset of the war, the current picture of courage was that of a soldier advancing unmoved upon the enemy and meeting death without a lament. But the special conditions of the present war have been met by an adaptation, in which courage has taken a form more useful in the circumstances. It is only the novice in the trenches that shows bravado. In the first months of the war, when an officer called for volunteers for a specially dangerous task, there were always twice as many as were wanted. But now the men prefer that the officer designate who is to go; all are prepared to go without hesitation, but only within the limits of the needful as determined by the officer; and the



soldier prefers that the responsibility for special exposure rest with the officer rather than with himself. Courage has thus taken a less impulsive, more rational form. The degree of courage varies from day to day and from hour to hour, often without obvious cause. Stimuli that raise its level include (1) the example of a superior, acting by motor suggestion (or "sympathy") to produce the behavior and secondarily the state of mind of courage; (2) the presence of an inferior arousing one's self-assertion or sense of responsibility; and (3) the presence of comrades. Acts of insane heroism done through excess of fear are very rare, probably because the neurotic individuals who might behave in this way have been weeded out before reaching the front. Trench life seems to leave no obsession of danger behind, except in cases of exhaustion.

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## VISUAL MOTOR FUNCTIONS

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In each of the five years since our last review of visual motor functions the number of relevant titles has decreased. Superficially this might seem to indicate that psychological interest in the eye-movements was also gradually decreasing. That this apparent indifference is not real there is evidence in the call for photographic recording apparatus and in the informal reports of investigations under way. The falling off in titles seems rather

to be due to a change of emphasis from direct investigation of the eye-movements themselves to a study of their interrelation with other activities. The reviewer believes that this reactionary shift of emphasis is unfortunate if it indicates a tendency to regard our present data as adequate for the interpretation of related psychological problems. As the recent studies show, the unsolved problems concerning the eye-movements are both important and numerous.

Of new methods there is only one to report. Gertz (3) used changes in the shape of the phosphenes which are produced by the retinal currents of action to indicate eye-movements. The method is certainly ingenious. We have no comparative data on which to estimate its relative sensitivity. All the traditional methods have been used more or less in the papers reviewed. A pneumatic device activated by the eccentric cornea is described by Schackwitz (11). He mounted a distended rubber capsule on a spectacle frame so that it rested on the eye-lid at the edge of the cornea. Distortion of the capsule produced by eye-movement was recorded by a sensitive tambour on smoked paper, or by a Marbe smoke recorder. Schackwitz calls attention to the safety, simplicity, and general availability of his device. The accompanying curves of reading differ widely in the accuracy with which they represent the true eye-movements which are involved in reading. This perhaps indicates only the lack of a standard technique of adjustment. The unnatural partial closure of the recording eye, the interaction of lid-movements, and the impracticability of any quantitative evaluation of the amplitude of movement, seems to limit the usefulness of the method to a record of the number of fixation pauses. For such a purpose some such instrument as Freeman's<sup>1</sup> is simpler and probably more reliable. Direct observation of superficial topographical marks was used by Gertz (3), Loring (7) and Oehrwall (10). After-images were used by Gertz, Marx (9), and Oehrwall. Gertz also used a sensitive ophthalmological method, observing the retinal image of a Nernst lamp filament at the optic disk. The cinematograph was used by Weiss (13), but apparently without knowledge of Judd's important contributions to the method.

German and Scandinavian writers are commonly using the descriptive class term "saccadic" to denote the rapid eye-movements for which we have only the arbitrary name of "type 1." I am not sure with whom the term originated, but it seems worth

<sup>1</sup> Freeman, F. N., *Experimental Education*, 1916, p. 95.

adopting. The class term "gliding movements" as used by Gertz seems less valuable. The several classes of "gliding movements," viz., the pursuit, coördinate, reaction compensatory, convergence-divergence, and torsion movements are so different in origin, latency, and angle-velocity that they can seldom properly be grouped as one class. The only common element seems to be that all the gliding movements are moments of relatively clear vision.

All the main types of eye-movements are represented in the studies under review. The angle velocity of the "saccadic" movements was measured by Weiss (13), for movements of approximately 35 degrees in various directions. The average duration was 0.106 second; raising the line of regard was slowest, 0.130; lowering it was most rapid, 0.080. The duration of concurrent lid-movements in raising and lowering the eyes coincided closely with the eye-movements. Weiss reports that there were no lid-movements with horizontal eye-movements. This is certainly not universal.

Oehrwall (10) compared the accuracy of fixation of a motionless point and a point moving in straight lines and regular curves. Fixation under the latter circumstances was better, especially when the head was unrestrained. He independently rediscovers and thus confirms a number of eye-movement phenomena; such as the inability to see during saccadic movements, the general incapacity for voluntary pursuit glides without adequate stimuli, the irregularities of fixation, together with the pulsations of a supposedly rigidly held head.

The lack of latency and the relative accuracy of the coördinate compensatory movements is independently rediscovered by Gertz (3). He found errors of less than 5 per cent. in half his subjects, though one subject showed overcorrections of 20 to 30 per cent. He rediscovers the tendency for the compensatory movements to overpower the intention to fixate, when the two are opposed. Studying the limits of successful pursuit, he found fewest intercurrent saccadic, corrective movements when the angle velocity of the fixation object was one degree per second. Saccadic movements increased as the velocity decreased, until at ten degrees per second differentiable pursuit glides entirely disappeared. The accuracy of pursuit is notably decreased by fatigue. He rediscovers pursuit movements with peripheral stimuli. But he also reports true pursuit movements when he tried to follow movements of his hand in the dark. Still more surprising was his development

of the capacity to glide across a fully illuminated visual field. This is contrary to all previously published observations. Unfortunately no graphic records of these eye-movements were made. In his own case he depended on the somewhat dubious glide "feeling," supported by the visual illusion of motion. But he directly observed these gliding movements in the case of his brother who apparently developed the unusual capacity as a child at play. Graphic records alone would indicate how far convergence tendencies might account for the phenomenon. His theoretical discussion suffers from his lack of familiarity with the psychological literature concerning the rôle of the pursuit movements in the perception of motion.

The extraordinarily comprehensive study of the compensatory eye-movements reacting to semi-circular canal stimuli by Högyes (5) is translated by Sugár from the Hungarian original in the *Annals* of the Budapest Academy of Sciences. This otherwise inaccessible work has more than historic interest. It is a mine of fine observations and operative experiments.

Convergence capacity was measured by Howe (6) by the use of prisms, not only with respect to the initial strength of the respective muscle groups, but also with respect to its fatigue.

An excellent survey of nystagmus is given by Bartels (1). The paper may properly be called a compendium of nystagmus.

Torsion movements were studied by Miss Loring (7), with an excellent telescopic technique. She found the phenomenon highly irregular. While increasing deviation of the line of regard from the primary position was in general accompanied by increasing torsion, the latter varied enormously for different individuals and more or less also for different eyes of the same individual. Vertical and horizontal movements are accompanied by torsion as well as oblique.

With respect to the interrelation of the various types, Wichodzew (14) found that compensatory torsion of the eyes, consequent to inclination of the head towards either shoulder, decreases the binocular field of regard as well as the capacity for divergence and convergence. These restrictions of motility seem to follow from the partial contraction of the eye-muscles in maintaining the reflex torsion, thus preventing their free interplay for other operations.

A "peripupillometer" made by Zeiss and described by Schlesinger (12) is capable of unusually precise adjustments. Schlesinger found a normal pupil threshold of 0.7 meter candles, varying with

age and other conditions. The reflex is fatiguable; but when fatigued for one color it is unfatigued for others. The central receptor area for the pupil reflex he found to be 3 mm. in diameter. Forster and Schlesinger (2), using the latter's peripupillometer, found no pupil unrest for either normal or pathological subjects, if the eyes were accommodated for distant vision and the illumination was weak. The authors refer the unrest that Weiler found either to changes in light intensity or to slight changes in accommodation. The lack of pupil unrest in dementia præcox under similar circumstances follows from the indifference of the subject to external stimuli.

On the basis of its retention in cases of paralysis of the oculomotorius, Hess holds that the pupil reflex in near vision is associated with accommodation rather than with convergence.

MacDougall (8) sought to ascertain the influence of eye-movement in judgments of number by comparing judgments of the number of stimuli in configurations which were supposed to limit eye-movement with similar judgments when the stimuli were in configurations which were supposed to induce eye-movements. It is incomprehensible to the reviewer that the author made no effort to use any of the various standard means of observing or recording the eye-movements which were actually induced by his arrangements of material. His assumptions concerning the influence of configuration on eye-movement affect to ignore the experimental work of Stratton, Judd, McAllister and others. He worked under the illusion that clear vision is possible during eye-movements of the first type. These omissions are the more deplorable since his study of the effects of configuration on judgments of number is so thorough. His assumption that these effects are the results of eye-movement tendencies seems to be rendered untenable by the fact that in the one instance in which eye-movements were experimentally introduced, the experimental results are opposed to his generalizations.

Marx (9) sought to determine the value of sensations from the external eye-muscles and conjunctiva for spatial orientation, by measuring the accuracy with which the eye could maintain a given position after the preliminary fixation mark had disappeared. Deviations from the original position were measured on a coördinate system by the apparent eccentricity of the after-image of a Nernst lamp filament, which was exposed by a photographic shutter at the original fixation point, after the eye had been left a prede-



terminated time in total darkness. He found that in general the deviations from the original position increased directly with the time up to ten seconds. They regularly showed characteristic individual peculiarities of direction and amount. They were decreased by peripheral marks, but were increased when the original fixation position differed from the primary position of the eye. Since in the latter case the muscle sensations are increased, Marx concluded that sensations of muscle strain play no important rôle in the maintenance of position. He also rules out sensations from the conjunctiva, because cocainizing the tissues had no effect on the errors. Muscle and conjunctiva sensations can only supply gross data for orientation. The tendency to approximate the original position of the eyes even in the dark is ascribed to the general tendency of the eye with relaxed muscles to return to the primary position. He explains autokinetic phenomena by the hypothesis of nystagmoid drifts of small extent. The novel question as to how accurately one can fixate the unmarked center between two peripheral stimuli in an otherwise darkened room found experimental answer in close analogy with the errors of fixation in the dark.

The occasional observations of concurrent eye-movements in special studies like reading, the perception of motion, the effect of drugs, and disturbances of the inner ear lie beyond the scope of this review.

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## REACTION TIME

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Topciu (3) studied successive reactions with the right and left hands to two stimuli with ten graduated intervals from 50 $\sigma$  to 720 $\sigma$ , the problem being to determine the dependence of the reaction times on the amount of the interval. With the shorter intervals the time of the first reaction was lengthened through the inhibiting and distracting influence of the second stimulus. The time of the second reaction decreases uniformly, as the interval increases, up to the optimal interval of 520 $\sigma$  and then increases again. The threshold value between a unitary and a discrete apperception of the two stimuli is calculated to be at about 229 $\sigma$  or half the optimal interval. When the length of the intervals was known the effect of the shorter intervals was much less marked though here also there is an optimal interval of about the same length as with irregular variation of the intervals.

Woodrow (4) finds that the reaction times to the cessation of sound and light stimuli and to the beginning of the stimuli show no appreciable differences. Differences between sound and light reactions and variations with the intensity of stimuli are the same for cessation as for beginning. The bearing of these facts on the various theories of nervous action is discussed in detail. "The explanation of the experimental data . . . seems to require us to regard the central nervous system as not merely a network of paths, but also as a seat of a complex system of interrelated activities and potential energies which is disturbed by any change in any part of the system. The fact of cessation reactions can not be adequately explained without postulating such a central system

of energies, the balance of which may be upset by either an increase or decrease of activity in any part of the system."

Burt (1) found in tests of subjects walking on the street under various conditions of illumination that the attention is at a higher level, auditory reaction time is quicker and the efficiency of motor coördination is greater under a non-uniform street illumination than under a uniform illumination. Experiments in the laboratory, with rhythmic variations in illumination intensity in the room or shadows to reproduce the street conditions as nearly as possible, corroborate these results though the effect in the laboratory was less marked. The practical implication is that "non-uniform illumination is more conducive than uniform to safety on the street."

Poffenberger and Morgan (2) subjected Dunlap's method of adjusting the Hipp chronoscope without armature springs to a rigid test and concluded that the method is more accurate than that with the spring adjustment and removes the necessity of accurately controlled current source, when the four conditions—the equality of windings and cores in the two sets of magnets, the equality of currents in the magnets, the proper adjustment of the chronoscope, and that the current acts upon the two magnets for approximately the same length of time or that this difference has no appreciable effect—are fulfilled.

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## RIGHT- AND LEFT-HANDEDNESS

BY STEVENSON SMITH

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Doll (1) confirms the results of earlier investigations in finding the incidence of left-handedness far greater among the feeble-minded than among normal subjects. He says (p. 58): "The feeble-minded of all grades are predominantly left-handed in strength of grip, as is shown by the superiority of the averages for left grip over right and the high correlation existing between them. These results do not show a tendency toward ambidexterity but towards sinistrality at all ages and grades." Examination of his tables shows the following results: of the 123 girls whose grip was measured 47 per cent. had greater strength in the right hand, 6 per cent. had equal strength in the two hands and 47 per cent. had greater strength in the left hand; of 310 boys there were 51 per cent. with greater right grip, 5 per cent. with equal grip for the two hands, and 44 per cent. with greater left grip. Those with a greater left grip show a greater relative difference between the strength of the two hands than do those with a greater right grip.

Nice (5) reports the case history of a left-handed child who, for the first two years of her life, was encouraged to use her right hand. After two years this effort at training was discontinued. She showed delayed speech development with sudden improvement at three years and seven months. The author's opinion that the retarded speech development was caused by training the right hand is not a conclusion necessitated by the results cited.

In a readable little book on ambidexterity Macnaughton-Jones (4) reviews some of the experimental results in studies of right- and left-handedness, gives some attention to the neurology of these functions, and deals at length with the advantages of bimanual education.

Jones (2) made measures of girth, length and tapping rate for the two arms of right- and left-handed subjects, as well as of those whose handedness had been reversed by training. He reports that bone measurements are diagnostic of born handedness whereas muscle measurements are diagnostic of adopted handedness. The ten thousand cases said to have been measured are not reported in full, only sample cases being given. In rate of tapping the group whose preferred handedness was transferred by education do not

show as great facility with their best hand as do either of the other two groups.

Lippert (3) contributed a brief note upon experimental work done on sixty-one boys. The material given does not admit of any conclusions being drawn.

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### FATIGUE, WORK, AND INHIBITION

BY EDWARD K. STRONG, JR.

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Crile (2) presents a well-rounded theory as to the causes and effects of fatigue. The adaptive mechanism by which man adapts himself to his environment is called the "kinetic system." This is made up of the brain, adrenals, liver, thyroid, and muscles. The brain is activated by the environment within and without the body and is the initiator of the response; the adrenals act as oxidizers, making possible the transformation of energy and the neutralization of the resulting acid products; the liver is the chief fabricator and storehouse of the carbohydrate fuel by which muscular action and heat are produced, and it also plays a rôle in the neutralization of the acid products; the thyroid through its secretion facilitates the passage of the nervous current and in consequence would seem to govern the rate at which the transformation of energy is affected; the muscles perform work through the transformation of energy into heat or motion. Regardless of the cause of activation, whether it be physical or mental work, shock, emotion, or the presence of toxins, there results identical changes in the brain, adrenals, and liver. "Increased activation produces increased acidity which in turn throws increased work upon the organs by which the neutralization of work is accomplished." Depending upon the cause of activation and the particular strength or weakness of the various organs of the body there results from



excessive activation normal fatigue, exhaustion, neurasthenia, insanity, Graves' disease, cardiovascular disease, diabetes, indigestion, Bright's disease, apoplexy, acute acidosis, etc. According to Crile, fatigue and exhaustion are general results due to the sum total of available potential energy being expended.

Dockeray (3) finds "that the effect of physical fatigue upon mental efficiency, as expressed by addition and multiplication, is very irregular." He presents two theories which seem to be more or less borne out by his results, although he is doubtful if the first one could be made to account for all the facts. The two theories are: "(1) It may be that fatigue products generated by the physical work, either in the motor neurones or in the muscles, spread through the circulation to the association centers and cause directly a diminution in the efficiency of the association processes; or (2) it may be that the sensations that accompany fatigue serve as distractions and thus cause a decreased attention."

Lahy (5, 6) finds no change in blood pressure as the result of soldiers marching all day, but does find it in the cases of linotype operators and an assistant working about the laboratory all day. Other more mental operations, such as attention, memory, visual acuity, etc., do not show any characteristic changes.

Painter (9) attacks Thorndike's assertion that, when Miss Arai required twice as long after twelve hours' work to multiply mentally a four-place by a four-place number, this did not mean a reduction of 50 per cent. in efficiency, for if she had then attempted a three-place by a four-place number she would still have shown more than 50 per cent. efficiency. After preliminary practise and after a hard day's work, he commenced multiplying four-place by four-place numbers. From 11 P.M. until 3.07 A.M. he continued with a steady increase in time devoted to each problem. When he was unable longer to do this task he attempted a three-place by a four-place but could not do this either. "When ability mentally to multiply a four-place by a four-place number had come to a stand-still as a result of extreme mental fatigue, ability mentally to multiply any number by any other number was lost."

Poffenberger and Tallman (10) find in short mental tests lasting less than a minute upon long-practised subjects that the first half is done almost always in less time than the second half. They conclude that "mental fatigue is not so rare as is sometimes supposed, but that the repair process is so rapid compared with muscle repair, that as work is usually done, the loss may be compensated for during brief intervals of relaxation."

Robins, Smith, and Washburn (11) report that on the whole "affective sensibility to colors tends to diminish with ennui produced by a long series of judgments," but there were, however, many exceptions to this general tendency.

Langfeld (7) studied simultaneous and alternating finger movements in tapping and found many interesting cases of inhibition. For example, if the index and second finger are tapped simultaneously the resulting rate is faster than the rate of the slower finger and may even be more rapid than the faster finger when tapping singly. This is explained on the ground that both fingers tend to move together as a result of the biologically important grasping reflex. When either is forced to tap alone, the other must needs be inhibited and this inhibition apparently is extended somewhat to the motor half center of the first finger. When both fingers move simultaneously this inhibition is removed.

From experiments on javelin throwing Murphy (8) concludes that "learning periods can be distributed by giving alternate days practise and even weekly practise without any loss in learning." He goes farther and suggests that "better work, for the amount of time expended, can be done in our schools through a distribution of three times per week than through a distribution of five times per week." Bradford's (1) study of the learning of typewriting confirms in many ways earlier work, such as that of Book on the learning process, and of Starch and Pyle on the effect of various intervals of work and rest.

A somewhat different phase of the problem of fatigue and work is presented by Huntington (4) and Woodruff (12). Both these writers call attention to the influence of climate on man's industry and culture. The former has gathered together data concerning the wages of men and women employees in Connecticut, Pennsylvania, North Carolina, South Carolina, Georgia, and Florida; concerning the death-rate in New York state; the gain in weight of tubercular patients; grades of students at Annapolis; etc. From a study of these data he concludes that "the best climate would be one in which the mean temperature never falls below the mental optimum of 38 degrees or rises above the physical optimum of 60 degrees, or possibly 65 degrees. The second most important factor next to temperature is change of temperature from day to day. Regions within the cyclonic storm area are thus favored over those not so situated. On the basis of such figures he constructs a map of the world showing favorable and unfavor-

able climate to man. This map agrees surprisingly well with another showing degrees of civilization based on a sort of "order of merit" questionnaire from 54 leading geographers. The last third of the book is devoted to an explanation of the rise and fall of civilization on the basis of fluctuations in the climate of the earth. Woodruff's work is devoted, on the other hand, more particularly to the effect of various ether waves, such as ultra-violet, etc., on man. He makes much of the presence or absence of pigmentation in the skin of man as indicative of adaptation to different climates. The blond type is superior intellectually to all others, but can never become acclimated to hot areas (meaning high intensities of light). Brunettes, on the contrary, do not do well in cold, cloudy regions.

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## PSYCHOLOGICAL EFFECTS OF DRUGS

BY A. T. POFFENBERGER, JR.

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The drug experiments of most interest to psychologists are those done by Dodge and Benedict (2, 3) on the psychological effects of alcohol, both on account of the results reported and the technique developed. Special reviews of this work appear elsewhere. Lange and Sprecht (7) have continued earlier work upon the influence of small doses of alcohol upon the senses. They had formerly found that the stimulus threshold of the auditory mechanism was lowered by small doses of alcohol, while the difference threshold was raised. They now report substantially the same for the sense of vision. The threshold for visual stimuli is lowered and the difference threshold increased by small doses. Variations in the size of the dose cause only a quantitative change in the threshold. Great individual differences appear depending upon the degree to which the subjects are accustomed to the use of alcohol. No reaction appeared at any time after the dose, such as to raise the stimulus threshold above the normal or lower the difference threshold below the normal; there was merely a gradual return to the normal. The authors venture the opinion that these effects of alcohol will be found common to all senses.

Jörger (6) studied the effect of alcohol poisoning upon the association processes, attempting to establish an association type for alcoholics, very much as has been done for imbeciles, epileptics and the like. The association records of the alcoholics were compared with the norms of Jung and Riklin. Experiments were conducted in the ordinary fashion, with a first repetition of the test after ten minutes as a test of reproduction, and later repetitions during recovery from the effects of alcohol. The results show that alcohol poisoning produces a lengthening of the reaction time, a tendency to repeat the stimulus word or the previous reaction word, an increased number of personal reactions, reduced number of *sprachlich-motorisch* associations, an increase in the number of nonsense reactions and perseverations, poor reproduction after ten minutes, a tendency to sentence responses and an increase in the number of sound associations. Arlitt (1) determined the effect of large doses of alcohol upon the intelligence of the white rat, as indicated by the speed of learning a maze. Rats fed alcohol

averaged a longer time in the maze and made more errors both at the beginning and during the latter part of the training period, than normal rats.

Porter (11) used the Martin method of measuring faradic stimuli to determine the threshold of the flexion and extension reflexes in the cat, as affected by strychnine. A 0.1 solution of strychnine sulphate was injected into the jugular vein. Out of 15 tests, nine showed a lowering of the thresholds of 8 to 98 per cent. In the other 6 cases, all of which were flexion reflexes, no lowering of the threshold was detected. Porter found, however, that if the flexion reflex was previously raised by drugs or otherwise, then strychnine caused a lowering of the threshold. The interpretation of these results is that strychnine will produce a state of maximum excitability in any reflex, but some reflexes are normally nearer this maximum or, as in the case of some of the flexion reflexes, are normally in a state of maximum excitability. In the latter case strychnine could produce no change. Strychnine has a tendency to bring all of the reflexes to the same maximum speed. The great excitability of the flexion reflex mechanism approaching the maximum is probably due to the fact that this is a protection reflex, very frequently used, and one which to be of service must be set on a hair trigger. Lashley (8) measured the effect in the albino rat of caffeine and strychnine upon the rate of learning the maze. Comparison with the performance of normal rats indicated that strychnine in large doses facilitates learning, while caffeine retards learning. Retention, on the other hand, seemed unaffected by either drug. In no case were serious after effects noted.

Dongen (4) found that the nerve centers differ in the extent to which and the speed with which they become adapted to morphine. The breathing center may become adapted to 1,800 times the initial dose, while the vagus center is not adaptable. Adaptation is due not only to a destruction of the poison within the body, but a special immunity develops against it in certain centers. Jones (5) studied 41 cases of drug addiction, as to occupation, status in society, drug used, how the habit was formed, etc., and found interesting differences. He concludes that drug taking is a cause of insanity, and forms a great public danger. Macht, Herman and Levy (9) made a quantitative study of the effect upon the pain sense of various opium derivatives. Among other facts, they found that morphine is the most powerful analgesic of this



group. Interesting individual differences were noted. All tests were made upon individual pain spots with an electric stimulus, and a striking constancy of the pain threshold was observed during several hours, together with a high sensitivity to slight changes in current strength in normal or control subjects.

McCord (10) fed pineal gland tissue to chickens, dogs and guinea pigs, and noted the change in development as compared with the growth of control animals. He found increased weight, increase in development of the sex functions, and in the case of dogs, an increase in mental development, the last being indicated by earlier ability to lap milk, to respond to a call and to find their way back to the kennel. These are the same symptoms that appear in some cases of pineal tumor, where the tumor growth probably retains the function of the gland.

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## SPECIAL REVIEWS

*The Influence of Joy.* G. V. N. DEARBORN. Boston: Little, Brown, 1916. Pp. xviii + 223.

The editor of the Mind and Health series in which this little book appears speaks of it in his introduction as "a well-proportioned comprehensive survey of the work done by all who have shared in the task of scientifically studying the effects of emotional states on the organs and processes of the body." It is no such thing. The author more modestly and truthfully describes it as "an essay intended to set forth some of the hygienic and therapeutic sanctions of organic happiness." This he proceeds to do *con amore* with no very great regard to precision of style and with an exuberance of cheerfulness inseparable perhaps from the subject. As the book is meant to be popular and, in particular, practical, it calls for no extended notice here. It is divided into two parts, the first treating of the Power of Joy, the second of its Necessity. It is in the former that a report is made of some of the work in recent years on the connection of emotional states with nutrition, circulation, the nervous system, etc. We are assured that gladness as an effective agent in behavior is eminently easy of cultivation, but little specific direction is given as to either its cultivation or its sources, and, strangely enough, the word laughter is not found in the index. The most psychological of the chapters is the first, but that is disappointing. To take a single instance. On p. 23 we learn that both autonomic and cerebro-spinal influences are concerned in the bodily phases of emotion and that the total effect is perhaps change in every organ and in every part of almost every tissue of the body; the opinion, therefore, is not unreasonably expressed, that it is the indefinite number of combinations possible between these physiological elements which accounts for the complexity of emotional expressions and their variety. This, vague and general though it is, is probably correct. But on p. 20, obsessed by the importance of "kinesthesia," the more specific doctrine is asserted, that the variety of affective experiences is due to the group-uniqueness of the "joint-muscle" sensations. We have to bear in mind that the author is an adherent of what he calls the "James-Lange-Sergi" theory. On the whole the reader will perhaps be disposed to agree with the author's own estimate of the scientific interest of the book, namely that it is "narrow and problematic" (p. 218).

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*A Beginner's Psychology.* E. B. TITCHENER. New York: Macmillan, 1915. Pp. xvi + 362.

This latest text-book of Titchener supplants the old *Primer*, but it has been so thoroughly rewritten that it cannot properly be called a revision. It is, in fact, a new book and one written in Titchener's best style. In reading it one feels that the author has thoroughly enjoyed his task. He has written it as he would speak to his class and one is inspired by his enthusiasm and stimulated by his personality, for it is, every line of it, thoroughly Titchener. Throughout there is the aim toward simplicity and clearness without sacrifice to truth. The style of the book, though to some extent conversational, is dignified, for the desire to interest never encroaches upon the serious treatment of the facts.

The student is never left long with abstractions. Wherever possible concrete illustrations are introduced from personal experiences, from readily imagined situations and from good, modern literature such as the writings of J. M. Barry and Lafcadio Hearn. As an example of his style we may quote from his chapter on "Action," p. 234: "Now for the illustration! Suppose that, as I am writing this paragraph, it occurs to me to look up a reference, for quotation, in a particular book that stands on the shelf by my side. I turn toward the shelf, recognize the book, take it in my hand and turn the pages, and presently find the passage I had in mind to use, etc."

Important facts are so embodied in the text that the student should remember them without conscious effort. Theory is not introduced until sufficient and yet not a confusing number of facts have been presented to form a background for a complete understanding. It seems to the reviewer that pedagogically the plan of this book is far superior to a perhaps more systematic one where the text is broken into short paragraphs with large headings, where definitions abound and each set of facts is rigidly classified. The student, in such cases, feels everywhere the one command "memorize" and when he has finished he has a storehouse of words without love or meaning.

Titchener has always considered it wise, even in an elementary text-book, to give the students the pros and cons of a theory and to avoid as far as possible dogmatic statements when the subject is still in doubt. He finds, for instance, that Cannon's work on the emotions supports his objections to the James-Lange Theory. He cannot regard the "organic commotion" as sufficiently differ-

entiated to distinguish any particular emotion from the rest. He adds: "From an æsthetic point of view we may regret this conclusion; it is always more satisfactory to end up a discussion with some positive, clean-cut statement than to leave the subject with a 'safe' generalization and a balanced judgment; but when we are seeking scientific truth, we may not outrun the facts we have; and when a science is in the making, the facts will not often round off prettily into a comprehensive theory" (p. 222).

The student is referred to a good physiology for a knowledge of the central nervous system. The physiological facts necessary for an understanding of the processes underlying the sensations are described in the most elementary manner, at times almost too picturesquely. At the end of each chapter is a long list of questions, many of which are very original and they should stimulate the student to independent thought and investigation. In the text there are frequent references to previous statements, which method will aid the students to knit the separate facts into a comprehensive system.

The author lays his principal emphasis upon inducing the student to assume the proper psychological attitude toward the various problems rather than to the amassing of facts. Owing to the confusion which one finds continually in the psychological literature, the point most persistently insisted upon is an avoidance of the stimulus error or more broadly stated, a proper psychological attitude toward "meaning." A clear understanding of the psychological problem of meaning will help the student for all time to keep his psychology free from epistemological, philosophical and ethical considerations.

Psychologists are familiar with Titchener's methods and views from his *Text-book*, but that book was written some six years ago and his opinion on a number of subjects has been changed by the results of recent investigation as well as by important developments in his own manner of thinking. Introspective facts, of course, form the foundation of his deductions, but the word "introspection" has led to so many misunderstandings that he hopes the time will soon be ripe when he can cease to use it. The term "consciousness" has so many meanings that he no longer uses it in this book. We find in the preface: "Experimental psychology made a serious effort to give it a scientific meaning; but the attempt failed; the word is too slippery, and so is better discarded."

The author continues to rule out the subconscious from the

science as an aid to truth, for the reason that it is unnecessary and dangerous, yet he adds in all fairness that the concept has proven useful in the field of psychiatry and psychotherapeutics. In its stead we find throughout the book an explanation of subconscious processes in terms of nervous set and disposition, as for instance when the recent work of Wertheimer and others on the stroboscopic effect is discussed. Here we have the "perception of movement in terms of sheer brain-habit, of a settled nervous disposition that now has no mental corrélate" (pp. 133-134). The "determining tendency" is also referred to unconscious cerebration. This concept of a determining or guiding tendency is becoming of great importance to many psychologists and finds more mention than in the *Text-book*. Through it we get away from an explanation of the thought processes by the old mechanical notion of the association of ideas, which seemed so satisfactory, but which, in reality, was so fallacious.

A new and interesting development is the relation of attention to memory, imagination and the thought processes. The term memory is restricted to the revival of those experiences which are recognized. Recognition requires a feeling of familiarity which is a "sense feeling of the agreeable and relaxing type" (p. 178). Memory may occur either under primary or secondary attention. Under the first form it is remembrance; under the second, recollection. Likewise imagination may occur in either state of attention. When under primary attention it is receptive imagination, the imagination necessary to full comprehension, whether of a scientific discussion or a work of art. When under secondary attention it is constructive or creative imagination. "Thought goes on in the state of secondary attention; it is an experience of the same general type as recollection, constructive imagination, selective and volitional action" (p. 262).

There is an entire chapter devoted to "Sentiment," which denotes as used in this context "the feeling-complex which gathers about a judgment or an imaginative construction" (p. 290). Under this head are treated the intellectual, moral, religious and æsthetic attitudes.

A short appendix is devoted to dreams and hypnosis. The dream pattern is described and the Freudian theory of an underlying wish is criticized for its claim to a wider application than the facts warrant.

The book should prove of great value in an elementary course.



It is much better for the beginner than was the *Text-book* and should awaken in him a real interest and enthusiasm for the science as well as give him a sound foundation upon which to build. It is also, judging from its simplicity of style, one of the few text-books which can be recommended to the layman who desires an honest knowledge of the necessary facts of psychology.

HERBERT SIDNEY LANGFELD

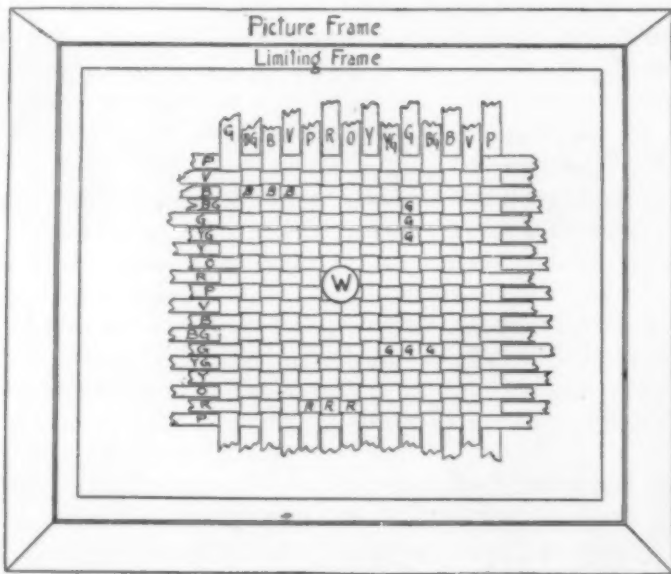
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## DISCUSSIONS

### PURKINJE DEMONSTRATION

A rather striking and simple demonstration of the Purkinje phenomenon, and that foveal vision is less acute in twilight than in daylight, can be made from a picture frame and the colored papers which are available in psychological laboratories.

The demonstration is based upon the principle that if foveal vision is less acute in twilight than in daylight, an area made up of small colored squares arranged into some regular form of checker-board pattern, will show the pattern less distinct in foveal vision than in peripheral vision when observed under twilight conditions.



Again, if the rods are absent in the fovea we should expect that a small white area (*W* in the illustration) which is distinctly visible in foveal vision in daylight, would, in twilight, disappear when fixated directly, but would again reappear when the fixation point is displaced to one side of *W*.

The mat which is here described and which is shown in the

above illustration demonstrates both these points quite clearly. For protection and easy manipulation the mat was placed in an old picture frame which held a glass 20 x 24 inches. On a black background of cardboard the mat was woven from strips cut from sheets of Milton-Bradley colored papers, the size of a full sheet being  $20\frac{1}{2} \times 24\frac{1}{2}$  inches. The colors used were red, orange, yellow, yellow-green, green, blue-green, blue, violet, purple, arranged to conform to their approximate positions in the spectrum. The colors were repeated in this order until the required width and length were covered. Any other colors arranged in any other order may of course be used, depending upon what particular pattern it is desirable to obtain.

For the long way the colored strips were  $\frac{1}{2}$  inch wide and for the short way  $\frac{3}{4}$  inch. The two sets of strips were then interwoven as shown in the illustration until the whole area of 20 x 24 inches was covered. This is a simple process if one begins in the center and works in both directions. When the weaving is completed the resultant mat will seem to be composed of many squares of different colors. In order to hide the ragged edges of the colored papers, a limiting strip, 1 inch wide, was cut from black cardboard and placed over the edges of the mat. This left the exposed area 18 x 22 inches when in the frame and covered with the glass. The squares of color are  $\frac{1}{2} \times \frac{3}{4}$  inches in size but at regular intervals three squares of the same color fall adjacent to each other and form an oblong as indicated by *B B B*, *G G G*, *R R R*. This helps to give the colors a definite pattern and avoids the confusion which might otherwise become a "riot of color." In the center of the mat is pasted a circle (*W*)  $1\frac{1}{2}$  inch diameter cut from pure white paper.

The mat here described is for observation distances of from five to ten feet. Where the mat is to be used to demonstrate to a large class in a large room that can be darkened to the proper degree, the paper strips should be wider, say 1 to  $1\frac{1}{2}$  inch, and the whole mat larger, perhaps 3 to 4 feet square.

For demonstrating to a small class the mat is taken into the dark room, placed against the wall so the light from the door will fall directly upon it. The students arrange themselves around the mat at a distance of 6 to 8 feet. At first the door is kept entirely closed for 3 to 4 minutes in order to hasten the dark adaptation. Then it is opened slightly so the mat is just visible. When the degree of adaptation and illumination is such that it is just

impossible to distinguish the colors, the following points may be demonstrated:

1. The small white circle (*W*) is invisible when fixated directly, but is clearly visible when any point on the frame of the mat is fixated.

2. When *W* is fixated the patterns immediately adjacent are less clear in brightness and outline than similar patterns lying nearer the periphery.

3. The foveal area tends to be filled in by imagery of the surrounding surfaces. It is only after attention has been directed to the fact that it is observed that the pattern covering the foveal area is less distinct than the peripheral areas. In this respect the demonstration gives an indication of how the blind spot of the retina is filled by imagery in daylight vision.

4. The pattern of the entire mat will have changed to a striped effect whereas in daylight the patterns will appear quadrilateral in character and much less definite.

5. When the illumination is increased so that the colors appear, but the outlines of the pieces are not yet clearly defined, the relief effect of the colors is very pronounced. The mat will appear to be made of mosaics which seem to be at different distances. Where the observer does not know that the surface is actually flat this relief effect is of course much more vivid.

The mat is also useful for class demonstrations in the perceptual processes. By changes in the direction of attention the colored squares can be grouped into a large number of different patterns. For those persons whose affective life is influenced by color tones this mat presents possibilities of affective experience hardly realized by the most ambitious cubist paintings.

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#### ON THE COMPUTATION OF THE STANDARD DEVIATION

The method of computing the standard deviation which will be described here is so simple, and is so direct an application of the common *Short-Cut* method that it seems unlikely the method has not been suggested before. A survey of the manuals on statistical methods has led the writer to believe that the procedure to be described is not widely used, although attention may have been previously called to it. That the method is of great

value is shown by the fact that the labor of computing the standard deviation becomes far less than that of computing the average deviation.

Any deviation is equal to the score minus the arithmetic mean. That is,

$$d = x - M,$$

$$x = d + M,$$

$$x^2 = d^2 + 2dM + M^2.$$

Now sum for all cases.

$$\begin{aligned} S(x^2) &= S(d^2 + 2dM + M^2) \\ &= S(d^2) + 2M \cdot S(d) + nM^2. \end{aligned}$$

Since deviations are measured from the arithmetic mean,

$$S(d) = 0$$

and therefore

$$S(x^2) = S(d^2) + nM^2.$$

Divide by  $n$

$$\frac{S(x^2)}{n} = \frac{S(d^2)}{n} + M^2.$$

Since  $[S(d^2)]/n$  = standard deviation squared, the square of the standard deviation equals (sum of the scores squared)/ $n$  minus the square of the arithmetic mean.

In actual work, if an adding machine that will carry two columns of figures is used, the following procedure is suggested.

Print in the first column the score and in the second column the square of the score. Thus

	5	25
	6	36
	2	4
	8	64
	7	49
Sum	28	178
Average	5.6	35.6
Subtract $M^2$		31.36

4.24 which is the standard deviation squared.

Extract the square root

2.05 which is the standard deviation.

This method has two advantages over the common method of



computation. (1) It is unnecessary to make a subtraction for each score. (2) The standard deviation may be found correct to any desired number of decimal places, simply by carrying the average to that number of places.

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## NOTES AND NEWS

THE PSYCHOLOGICAL REVIEW PUBLICATIONS have most unexpectedly become involved in the war. The American Consul General in London reported that a package of books by German authors sent us for review had been seized by the British government. We wrote explaining the harmless character of the books and suggested that any psychologist in Great Britain would corroborate this testimony after being informed of the authors and titles. The British Procurator General has finally decided that such publications are not entitled to free transit. The editors will not contest this decision in court. We shall, however, endeavor to give our readers as full, impartial, and untainted a review of psychological progress as is possible under existing conditions.

DR. ERICH BECHER has been elected as successor to the late Professor Külpe at the University of Munich. Becher has been *ordinarius* at Münster since 1909, and among other writings has issued a volume on "*Gehirn und Seele*."

W. H. NORCROSS, of Johns Hopkins University, has been appointed associate professor of psychology, philosophy, and education, in Dickinson College.

MR. BENJAMIN KIDD, author of *Social Evolution* and other publications dealing with social philosophy, died on October 2, aged 58 years.

